

Bank Efficiency, Regulation and Response to Crisis of Financial Institutions in
Selected Asian Countries

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Abstract

This paper studies the determinants of efficiency of banks in Southeast Asian countries of Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The study covers nearly 600 banks from 1994 to 2008. The study adopts the two-stage least square fixed-effects (FE2SLS) and two-stage least square random-effects estimators (RE2SLS) as provided by Baltagi (2001) to address individual bank heterogeneity and endogeneity issues related to bank efficiency. The paper focuses on three key areas: (1) bank specific activities such as off-balance sheet activities of banks, (2) financial liberalization through foreign participation and ownership, and (3) impact of bank regulation and supervision. The results of the paper indicate that off-balance sheet activities tend to reduce bank efficiency. The foreign participation and ownership in the financial markets tend to increase bank efficiency. Bank regulation in restricting activities on non-interest income and authority of official supervision tends to improve bank efficiency. Bank supervision through the intensity of private monitoring of the financial markets tends to reduce bank efficiency. The results of the paper indicate that bank regulation and supervision will be crucial to improve the efficiency of the banks and stability in the financial markets in the Southeast Asia.

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1. Introduction

With the pace of financial market liberalization, financial institutions are facing increasing competition and greater volatility from external shocks. In such an environment, efficient banks and financial institutions will have greater competitive advantage. Banking efficiency has also been argued to be important to maintain the stability of the financial markets (Berger et al., 1993; Schaeck et al., 2006). Efficient banks are, in addition, better able to diversify their activities and channel funds effectively to economically viable activities in the economy, thereby providing greater stability for the economy.

A competitive environment is a spur to efficiency but it may also increase risk taking activities as banks are forced to adopt non-traditional banking activities to maintain their share in the financial markets (Edward and Mishkin, 1995). The regulatory concern is that competition in the financial market could lead to excessive risk taking behaviour leading to instability in the financial markets. The 2007 global crisis provides examples of excessive off-balance sheet activities of banks. The traditional banking model was replaced by the “originate and distribute” banking model where loans are pooled, trached and then resold via securitization (Brunnermeier, 2009). Financial innovation that had supposedly made the banking system more stable by transferring risk to those most able to bear had an unprecedented credit expansion. To offload the risk, banks repackaged the loans and passed them to other financial investors through structured products often referred to as collateralized debt obligations (CDOs). Financial market regulation plays an important role in maintaining a balance between competition and risk taking activities in the financial sector, but in the process it may affect the efficiency of the financial institutions.

The determinants of efficiency of banks in the Southeast Asian countries of Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam are discussed in this paper. The

study covers nearly 600 banks from 1994 to 2008. The study is expected to help improve the institutional, regulatory and supervisory framework of financial institutions in the region by identifying factors that could contribute to their efficiency.

There are four key aspects of the paper. First, it studies the impact of financial market regulation on bank efficiency. One of the objectives of bank regulation is manage competition and the risk taking activities in the financial sector. In this case, bank regulation tends to retard competition and innovative activities of financial institutions, thereby affecting the efficiency of financial institutions. Recent studies also highlight the positive impact of regulation on banking activities in terms of increased market monitoring and a better-quality contracting environment, which has a positive impact on bank efficiency (Gonzales, 2009). In this paper, we study the impact of bank regulation and supervision on bank efficiency in terms of the regulation of the activities that generate non-interest income, the intensity of monitoring of banks by private sector organisations, and the extent of official supervision by the central bank. To our knowledge, this is first paper to address the impact of bank regulation and supervision on bank efficiency for Southeast Asian banks.

The paper also studies the impact of financial market liberalization, in terms of opening up the financial sector to foreign participation and foreign ownership, on the efficiency of financial institutions. Foreign banks are generally restricted in entry and operations in Asia and the penetration of foreign banks in Asia is much lower than in Central Europe and Latin America (Montgomery, 2003). Foreign banks in Asia are restricted in commercial lending activities and limited to few branches in comparison to the local banks. For example, in Indonesia, foreign banks are restricted geographically in lending activities in Jakarta region and in taking time deposits. In most Asian countries, foreign banks are restricted in access to the Central Bank

discount window and to subsidized trade credit facilities. In Korea, foreign banks are allowed only restricted branches within the city area, thereby restricting their access to local currency deposits, and as well as the total amount of deposit they could accept (Montgomery, 2003).

The impact of financial market liberalization is an important talking point following the experience of the Asian Crisis. Following the Crisis, Singapore liberalized its financial sector by increasing the foreign ownership and participation of foreign banks in the domestic economy. In contrast, Malaysia adopted capital controls that limited the flow of capital and also the role of foreign participation in the financial and domestic market. Malaysian policies are argued by some to have led in the short run to a faster economic recovery, smaller decline in unemployment and wages, and a more rapid turnaround of the stock market (Kaplan and Rodrik, 2001). But there is no clear evidence of the impact of capital controls in the long run on bank efficiency. An understanding of the impact of foreign participation on the productive performance of banks in the long-term is valuable. A recent study by Kose et al. (2008) also shows that financial openness has a robust positive impact on TFP growth in the domestic economy. A study by Xu (2010) provides strong empirical evidence that foreign entry led to a more competitive and efficient banking industry in China. However, Obstfeld (2009) says that there is little evidence of a direct positive impact of financial openness on the economic welfare of developing countries. The paper studies the impact of foreign ownership and participation in the financial markets on individual bank efficiency.

This study further examines the impact of the off-balance sheet activities of banks on their efficiency. Increasingly banks are using off-balance sheet activities in pursuit of higher bank profits and to satisfy the increase in demand for non-banking products by customers. These off-balance sheet activities could be associated with excessive risk taking which subsequently

affects efficiency. There is little research that examines financial innovation in terms of the off-balance sheet activities of Southeast Asian banks and this study intends to fill this gap. This is particularly relevant in the context of the experience of the global financial crisis.

The study, finally, contributes to the understanding of the risk of the misallocation of funds by banks arising from the moral hazard issues associated with state influence and guarantees (Radelet and Sachs, 1998). In this study, we used a bank's equity to asset ratios and its corporate linkages, via its own ownership structure or its links to subsidiaries, to capture the impact of the related moral hazard issues on productive performance.

The paper is organized as follows. Section 2 discusses the methodology. The construction of the data is presented in Section 3. The results are presented in Section 4. Section 5 provides the conclusion of the paper.

2. Empirical Methodology

The paper adopts panel data framework to study the determinants of bank efficiency. The regression equation is given as:

$$Bank-Efficient_{it} = \alpha_0 + \alpha_1 Fin_{it} + \alpha_2 Reg_{it} + \alpha_3 Types_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (1)$$

where $Bank-Efficient_{it}$ is the bank efficiency measure of bank i in year t ; Fin_{it} is the set of specific characteristics of Bank i at year t ; Reg_{it} is the set of bank regulatory and supervision variables; $Types_{it}$ captures the bank types; θ_t are dummies to capture any unobserved bank-invariant time effects not included in the regression; μ_i are unobservable bank-specific effects that vary across the banks but are constant over time; and ε_{it} are white-noise error terms.

We adopt fixed-effects and random-effects to estimate equation (1). It is very likely that there are endogeneity problems in equation (1) in terms of reverse causation, whereby bank regulation and supervision might be responding to the efficiencies of the bank. Thus failure to account for the simultaneity problems might lead to biased estimation and coefficients. To address this problem we adopt the two-stage least square fixed-effects (FE2SLS) and two-stage least square random-effects estimators (RE2SLS) as provided by Baltagi (2001). Both FE2SLS and RE2SLS are expected to control for the presence of unobservable bank-specific effects and potential endogeneity of bank efficiency.

3. Data and Construction of Variables

3.1 Data

The main bank level data for the study is obtained from BankScope Database. Bank-level information to estimate bank efficiency is taken from BankScope Database. All data used are expressed in 1996 US dollar terms and consolidated bank balance sheet and income statement data will be used whenever available. The construction of regulatory and supervisory variables is based on Barth, Caprio, and Levine (2004, 2006) and the World Bank's Bank Regulation and Supervision Database. The full description of the data is given in Table A1 in the Appendix.

3.2 Variables

3.2.1 Bank Efficiency Measure

To measure bank efficiency, we adopted the DEA (data envelopment analysis) analysis. This framework has been extensively used to study the efficiency of financial institutions as in Leightner and Lovell (1998), Gonzales (2009), Strum and Williams (2004), Casu et.al (2005),

Isik and Kabir (2003), and Wheelock and Wilson (1999)¹. Recent paper by Gonzales (2009) used DEA to measure the bank efficiency of commercial banks in 69 countries to study the impact of political economy variables on bank efficiency. Isik and Kabir (2003) utilized DEA analysis to examine productivity growth and technical progress in Turkish commercial banks during the deregulation of financial markets in Turkey. Strum and Williams (2004) adopted the DEA framework to study the efficiency of banking in Australia during the post-deregulation period 1988 to 2001. Casu et. al (2005) examined the efficiency of European banks for the period 1994-2000 using the DEA framework found Italian and Spanish banks have higher productivity increases as compared to German, French and English Banks.

Data envelopment analysis (DEA) is a nonparametric method to estimate production functions, particularly the productive efficiency of decision making units. DEA employs mathematical programming to estimate the tradeoffs inherent in the empirical efficient frontier. The efficient frontier identified by DEA is the benchmark against which other decision making units will be compared against (see Gonzales, 2009). Two alternative approaches can be employed in the determination of the efficient frontier: input-oriented and output-oriented approaches. In the input-oriented approach, the outputs of each decision-making unit are held at the current levels and the minimal amount of inputs required by an efficient producer to produce those specific levels of outputs will be estimated. A comparison between this optimal level of inputs required and the actual level of inputs each producer uses will yield an efficiency measure for each decision making unit. The output-oriented approach is similar, except that the inputs are kept fixed at the current levels and the maximum amount of outputs that can be produced at those levels of inputs will be estimated and compared against the actual levels of outputs of each producer. In the estimation of the efficient frontier, either constant returns to scale (CRTS) or

¹ See Berger and Humphery (1997) for application of DEA analysis in the financial sector.

variable returns to scale (VRTS) can be assumed. DEA efficiency scores ranges between 0 and 1, with 1 being fully efficient.

There are several advantages of DEA in terms of its application to the financial sector. It does not require knowledge of the explicit functional form or assumptions with regard to its stochastic error terms. This is particularly important as it is rather difficult to define the functional forms of bank production. Further, DEA does not require a large sample size to implement. In this study we adopt the input orientation to measure the efficiency of each bank with the assumptions of constant (Input CRS) and variable returns to scale (Input VRS). As in Berger and Mester (1997), DeYoung and Nolle (1998) and Gonzales (2009), we used three inputs: personnel expenses, book value of fixed assets and loanable funds (sum of deposits and non-deposit funds); and two outputs: total loans and noninterest income. In this approach, a frontier is calculated for each individual country and a bank's efficiency is measured relative to its country's own frontier (banks are equally-weighted).

The average bank efficiency measure using DEA for the selected Southeast Asian countries is given in Table A2 in the Appendix. Indonesia, Malaysia and Vietnam tend to have experienced low levels of bank efficiency among those countries in the sample. In fact, the bank efficiency for Vietnam is lowest among the 6 Southeast Asian countries. The average bank efficiency indicates that Singapore and the Philippines have the highest bank efficiency among the countries. It is interesting to notice that the banking efficiency of Malaysia is lower than that of Indonesia and Thailand and it is showing a declining trend over time except for 1999-2003. It will be interesting to examine if this result is due to the capital controls and restrictions on foreign participation imposed by Malaysia since 1998 after the Asian Crisis. We also notice that the banking efficiency is declining for all of the Southeast Asian banks except for Vietnam.

Although the bank efficiency measures for the Philippines, Singapore and Thailand are relatively high, they also decline in recent years.

3.2.2 Bank Regulation and Supervision

The study used three key regulatory and supervisory variables. The extent of bank regulations that restrict activities that generate non-interest income measured by the variable RESTRICT. This variable indicates if bank activities in the securities, insurance, and real estate markets and bank ownership and control of nonfinancial firms are unrestricted, permitted, restricted or prohibited. Higher values indicate a higher level of restrictions.

The bank supervision variables are represented by the intensity of private monitoring (MONITOR) and official supervision of banks (OFFICIAL). Both these variables were derived as given in Barth, Caprio and Levine (2004, 2006). The MONITOR index contains information regarding the external auditing of banks, ratings by international agencies, the availability of an explicit deposit insurance scheme, and the disclosure of risk management procedures to the public. The OFFICIAL index provides information regarding the extent to which regulators have the authority to take regulatory actions. Higher values for MONITOR and OFFICIAL indicate greater private oversight and more official supervisory power respectively.

3.2.3 Specific Characteristics of Financial Institutions

We used several variables to capture specific banking activities that could directly affect the productive performance of banks. Several studies have highlighted the importance of capital requirements. Higher capital requirements will have a direct impact on the risk taking activities of the owners of the bank. To capture this effect, we introduced the ratio of total equity to total assets ratio (TE_TA). In order capture the liquidity effects of the banks we used loan loss reserve to total loans ratio (LOANLR_GL), liquid assets to total assets ratio (LA_TA), and non-earning

assets to total asset ratio (NEA_A). The account for the off-balance sheet activities of banks, we used off-balance sheet to total assets ratio (OFFBAL_A).

The impact of foreign ownership and partnership on bank performance is given by a dummy variable, FOREIGN, which represents majority foreign ownership of more than 50 percent equity ownership of the banks. We also show whether the bank is a public bank (PUBLIC) if the government has more than 25 percent ownership. To capture the moral hazard issues related to banks taking ownership of banks and private companies taking ownership of the banks, we introduce the dummy variable SUBSIDIARY that indicates if the bank is a subsidiary or if it has a subsidiary. We also introduce dummy variables to capture the types of banking activities of the bank.

4. Results: Determinants of Bank Efficiency

The key trends of TE_TA (ratio of total equity to total assets ratio), LOANLR_GL (loan loss reserve to total loans ratio), LA_TA (liquid assets to total assets ratio), NEA_A (non-earning assets to total asset ratio) and OFFBAL_A (off-balance sheet to total assets ratio) are given in Table A3 in the Appendix. We also present the plots of TE_TA, LOANLR_GL, LA_TA, and NEA_A in Figures A1 to A5. In Figure A1, TE_TA tends to fall in the Asian crisis period of 1997-1999 and then it tends to increase during the post-crisis period of 2000-2008. Singapore and Thailand tend to increase its total equity to total assets ratio to nearly 20 percent in 2000-2008. The other selected ASEAN countries of Malaysia, Indonesia, The Philippines and Vietnam also increase its TE_TA ratio to nearly 15 percent. In particular, Indonesia experienced a TE_TA ratio of less than 5 percent in 1997-1999 and this increased to nearly 15 percent in 2000-2008.

The LOANLR_GL ratio tends to increase during an economic crisis and this is quite clear among the ASEAN countries in Table A2. Most ASEAN countries increased their

LOANLR_GL ratio in 2000-2008 to nearly 10 percent except Vietnam. The higher LOANLR_GL indicates that the financial institutions are holding higher liquidity reserve to ride volatility in output in the post-Asian crisis period. The higher liquidity asset holding is also reflected by liquidity assets to total assets ratio (LA_TA ratio) for Malaysia in Figure A3, where it is holding more than 25 percent of liquid assets of total assets. In comparison, the other countries are holding more than 15 percent of liquid assets of total assets

In Figure A4, the non-earning asset to total asset (NE_A) is nearly 30 percent for Malaysia in 2000-2008 indicating vulnerability of the Malaysian financial markets relative to other ASEAN countries. The vulnerability of Malaysian financial markets is also indicated in Figure A5, the off-balance sheet to total assets ratio (OFFBAL_A). Although the off-balance sheet to total assets ratio declined in 2000-2008, it still nearly 25 percent for Malaysia. The rest of the ASEAN countries are experiencing around 15 percent of OFFBAL_A ratio.

The results of the panel study are given in Tables 1 to 4. Tables 1 and 2 report the estimations based on bank efficiency measurement using constant returns to scale (CRS) and variable returns to scale (VRS) using fixed- (FE) and random-effects (RE) specifications respectively. To account for bank specific effects and endogeneity issues in our estimation, we adopted the two-stage least square estimation for fixed- (FE2SLS) and random-effects (RE2SLS) specification proposed by Baltagi (2001). We used the liquid assets to total bank deposits and borrowing ratio, the sample size for DEA estimation, and types of banks as instrumental variables in the estimation. The results of FE2SLS and RE2SLS estimation are reported in Tables 3 and 4. The results of our study are very consistent across both the fixed- (FE) and random effects (RE) specifications.

Table 1: Determinants of Bank Efficiency Based on Constant Returns to Scale Measure (CRS DEA –Input CRS) in Selected Southeast Asian Banks

	FE(1)	FE(2)	RE(1)	RE(2)
TE_TA	0.257** (2.280)	0.283** (2.490)	0.243** (2.540)	0.242** (2.150)
LOANLR_GL	0.074 (0.820)	0.078 (0.843)	0.099 (0.790)	0.035 (0.401)
LA_TA	0.009 (0.140)	0.051 (0.701)	-0.066 (-1.140)	0.019 (0.390)
NEA_A	0.135* (1.710)	-	0.116 (1.500)	-
OFFBAL_A	-0.011*** (-7.220)	-0.013*** (-7.424)	-0.010*** (-5.300)	-0.014*** (-7.820)
FOREIGN	0.029*** (3.531)	0.032*** (3.805)	0.053*** (5.660)	0.023*** (2.730)
PUBLIC	0.015 (0.962)	0.014 (0.930)	0.023 (1.550)	0.004 (0.320)
SUBSIDIARY	-0.089*** (-4.063)	-0.090*** (-4.071)	-0.117*** (-6.600)	-0.103*** (4.800)
RESTRICT	0.107*** (5.040)	0.099*** (5.210)	0.097*** (4.630)	0.096*** (4.530)
MONITOR	-0.495*** (-15.500)	-0.478*** (-15.750)	-0.464*** (-15.350)	-0.464*** (-15.350)
OFFICIAL	0.088** (2.875)	0.078** (2.780)	0.077** (2.580)	0.073** (2.460)
Commercial Banks	0.097*** (3.975)	0.106*** (4.302)	0.077 (0.160)	0.023 (0.520)
Investment Banks	0.192*** (6.330)	0.199*** (6.550)	0.114** (2.260)	0.125** (2.600)
Finance & Securities Companies	0.202*** (5.280)	0.208*** (5.260)	0.101* (1.610)	0.205** (2.355)
Savings Banks	0.072 (1.306)	0.073 (1.290)	-0.069 (-0.710)	-0.044 (-0.650)
Holding Finance Companies	0.069** (2.510)	0.074** (2.680)	-0.023 (-0.480)	-0.011 (-0.220)
Government Savings Banks	0.228*** (5.510)	0.232*** (5.710)	0.129** (2.170)	0.147** (2.631)
Islamic Banks	0.222*** (5.090)	0.231*** (5.320)	0.100* (1.650)	0.122** (1.920)
Others	0.089** (2.020)	0.094*** (5.080)	-0.015 (-0.260)	-0.086* (-1.690)
Constant	1.710*** (4.450)	1.791*** (5.080)	1.851*** (4.420)	1.874*** (4.650)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
R-Square	0.550	0.549	0.556	0.551
Obs	1359	1359	1359	1359

* - 10 percent level of Statistical Significance; ** - 5 percent level of Statistical Significance; *** - 1 percent level of Statistical Significance; t-Statistics in parenthesis; FE – Fixed Effects; RE – Random Effects

Table 2: Determinants of Bank Efficiency Based on Variable Returns to Scale Measure (Input VRS) in Selected Southeast Asian Banks

	FE(1)	FE(2)	RE(1)	RE(2)
TE_TA	0.408*** (4.030)	0.467*** (4.170)	0.370*** (3.670)	0.427*** (5.310)
LOANLR_GL	0.192** (2.890)	0.202*** (2.940)	0.148** (2.030)	0.151 (1.260)
LA_TA	0.023 (0.330)	0.115* (1.820)	-0.0008 (-0.130)	0.080 (1.330)
NEA_A	0.304** (2.940)	-	0.266** (2.870)	-
OFFBAL_A	-0.009*** (-3.360)	-0.013*** (-5.470)	-0.009*** (-3.680)	-0.013*** (-3.810)
FOREIGN	0.038** (2.200)	0.044*** (2.410)	0.036** (2.280)	0.041** (2.080)
PUBLIC	0.011 (0.470)	0.011 (0.440)	0.003 (0.150)	0.004 (0.180)
SUBSIDIARY	-0.078*** (-4.320)	-0.081*** (-4.610)	-0.104*** (-8.430)	-0.103*** (5.660)
RESTRICT	0.171*** (7.110)	0.153*** (6.410)	0.164*** (7.620)	0.148*** (8.690)
MONITOR	-0.572*** (-16.370)	-0.533*** (16.410)	-0.548*** (17.650)	-0.515*** (21.280)
OFFICIAL	0.189*** (6.390)	0.166*** (5.610)	0.179*** (6.280)	0.157*** (6.060)
Commercial Banks	0.128*** (4.190)	0.146*** (4.790)	0.040 (0.820)	0.138*** (4.510)
Investment Banks	0.176*** (4.130)	0.192*** (4.250)	0.099** (2.170)	0.194*** (5.240)
Finance & Securities Companies	0.185*** (4.000)	0.195*** (4.020)	0.093 (1.470)	0.183** (4.020)
Savings Banks	0.066 (1.310)	0.068 (1.230)	-0.062 (-0.810)	0.024 (0.390)
Holding Finance Companies	0.020 (0.690)	0.031 (0.980)	-0.069 (-1.370)	0.021 (0.610)
Government Savings Banks	0.210*** (5.700)	0.217*** (5.770)	0.116** (2.200)	0.204*** (4.270)
Islamic Banks	0.209*** (4.230)	0.228*** (4.830)	0.0093** (2.170)	0.196** (2.420)
Others	0.097* (1.880)	0.107** (2.050)	-0.081 (-1.450)	0.092 (1.080)
Constant	0.490 (1.400)	0.676* (1.840)	0.647* (1.760)	0.741** (2.190)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
R-Square	0.521	0.518	0.524	0.525
Obs	1359	1359	1359	1359

* - 10 percent level of Statistical Significance; ** - 5 percent level of Statistical Significance;

*** - 1 percent level of Statistical Significance

t-Statistics in parenthesis; FE – Fixed Effects; RE – Random Effects

Table 3: Determinants of Bank Efficiency Based on Constant Returns to Scale Measure (Input CRS) using IV Estimation in Selected Southeast Asian Banks

	FE2SLS		RE2SLS	
	(1)	(2)	(3)	(4)
TE_TA	0.606*** (6.240)	0.591*** (8.260)	0.567*** (5.460)	0.564*** (5.560)
LOANLR_GL	0.117 (0.820)	0.113 (0.640)	0.060 (0.340)	0.060 (0.430)
LA_TA	0.052 (0.76)	0.038 (0.480)	0.022 (0.360)	0.020 (0.330)
NEA_A	-	0.049 (0.330)	-	0.008 (0.070)
OFFBAL_A	-0.013*** (-3.840)	-0.013*** (-3.230)	-0.015*** (-4.750)	-0.015*** (-4.130)
FOREIGN	0.028** (2.630)	0.026** (2.550)	0.019** (1.940)	0.018* (1.670)
PUBLIC	0.011 (0.710)	0.012 (0.790)	0.001 (0.120)	0.002 (0.110)
SUBSIDIARY	-0.091*** (-3.580)	-0.081*** (-3.360)	-0.094*** (4.760)	-0.095*** (-4.020)
RESTRICT	0.112*** (5.360)	0.115*** (4.260)	0.179*** (17.660)	0.180*** (15.750)
MONITOR	-0.502*** (-16.080)	-0.508 (-11.700)	-0.488*** (-13.310)	-0.490*** (-12.530)
OFFICIAL	0.094*** (3.110)	0.098** (2.540)	0.159*** (7.900)	0.160*** (7.760)
Commercial Banks	0.089** (3.700)	0.086*** (3.160)	0.103** (2.960)	0.103** (2.990)
Investment Banks	0.164** (6.730)	0.160*** (5.780)	0.184*** (4.860)	0.183*** (5.180)
Finance & Securities Companies	0.201*** (5.280)	0.207*** (5.071)	0.220*** (4.310)	0.220*** (4.810)
Savings Banks	0.263*** (4.320)	0.262*** (3.870)	0.250*** (4.040)	0.250*** (4.250)
Holding Finance Companies	0.051** (1.980)	0.048* (1.750)	0.059 (1.600)	0.058* (1.710)
Government Savings Banks	0.207*** (4.450)	0.205*** (4.940)	0.215*** (4.970)	0.218*** (3.890)
Islamic Banks	0.225*** (3.050)	0.220** (2.550)	0.215** (2.430)	0.214** (2.660)
Others	0.126** (2.310)	0.123** (2.14)	0.129* (1.830)	0.128* (1.650)
Constant	1.621*** (4.610)	1.589*** (3.530)	1.680** (2.840)	1.675** (2.010)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
R-Square	0.590	0.589	0.591	0.590
Obs	1220	1220	1220	1220

* - 10 percent level of Statistical Significance; ** - 5 percent level of Statistical Significance;

*** - 1 percent level of Statistical Significance; t-Statistics in parenthesis;

FE2SLS – 2 Stage Least Square Fixed Effects; RE2SLS – 2 Stage Least Square Random Effects (Baltagi, 2001)

Table 4: Determinants of Bank Efficiency Based on Variable Returns to Scale Measure (Input VRS) using IV Estimation in Selected Southeast Asian Banks

	FE2SLS		RE2SLS	
	(1)	(2)	(3)	(4)
TE_TA	0.731*** (7.660)	0.653*** (6.280)	0.683*** (5.700)	0.616*** (5.690)
LOANLR_GL	0.236 (1.590)	0.216 (1.370)	0.155 (1.190)	0.146 (1.120)
LA_TA	0.108* (1.690)	0.034 (0.470)	0.073 (1.200)	0.006 (0.090)
NEA_A	-	0.250** (2.190)	-	0.207* (1.780)
OFFBAL_A	-0.015*** (-3.710)	-0.012** (-2.470)	-0.015*** (-3.170)	-0.012** (-2.410)
FOREIGN	0.040** (2.050)	0.033** (2.000)	0.037* (1.790)	0.031* (1.800)
PUBLIC	-0.012 (-0.690)	-0.011 (-0.520)	-0.016 (0.730)	-0.015 (-0.700)
SUBSIDIARY	-0.065*** (-3.740)	-0.064*** (-3.800)	-0.092*** (-5.430)	-0.093*** (-5.440)
RESTRICT	0.159*** (5.990)	0.176*** (7.610)	0.186*** (15.290)	0.193*** (16.140)
MONITOR	-0.556*** (-13.940)	-0.590*** (-16.910)	-0.535*** (-13.190)	-0.562*** (-13.860)
OFFICIAL	0.172*** (5.440)	0.193*** (6.430)	0.194*** (11.380)	0.206*** (11.950)
Commercial Banks	0.146*** (4.760)	0.128*** (4.290)	0.143*** (2.760)	0.130*** (2.560)
Investment Banks	0.177*** (4.060)	0.158*** (4.810)	0.182*** (3.150)	0.169** (2.960)
Finance & Securities Companies	0.214*** (4.310)	0.200*** (4.040)	0.201** (2.88)	0.194** (2.860)
Savings Banks	0.151*** (3.900)	0.154*** (5.050)	0.110 (1.600)	0.111* (1.880)
Holding Finance Companies	0.031 (1.030)	0.018 (0.610)	0.023 (0.460)	0.015 (0.340)
Government Savings Banks	0.223*** (3.940)	0.214*** (5.290)	0.213** (3.300)	0.207** (3.310)
Islamic Banks	0.302*** (3.270)	0.274** (2.830)	0.285** (2.800)	0.261** (2.471)
Others	0.167*** (3.010)	0.152** (2.180)	0.152* (1.750)	0.142 (1.650)
Constant	0.678* (1.770)	0.510 (1.390)	1.796** (2.020)	1.812** (2.960)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
R-Square	0.543	0.549	0.545	0.547
Obs	1220	1220	1220	1220

* - 10 percent level of Statistical Significance; ** - 5 percent level of Statistical Significance;

*** - 1 percent level of Statistical Significance; t-Statistics in parenthesis;

FE2SLS – 2 Stage Least Square Fixed Effects; RE2SLS – 2 Stage Least Square Random Effects (Baltagi, 2001)

4.1. Specific Bank Characteristic

It is interesting to notice that bank specific characteristics have important impact on the efficiency of banks. TE_TA, the capital requirement variable, is positive and statistically significant, which indicates that increase in capital requirements of banks tend to improve the efficiency of banks. This suggests that banks might experience better risk management if banks assume greater ownership of its activities. This result is in line with the recent recommendation by Basel II Accord to increase capital requirements to manage the risk taking activities of banks (BIS, 2006). This result is also robust to the estimation using a bank efficiency measure which assumes variable returns to scale (VRS) as given in Table 2. The estimation based on FE2SLS and RE2SLS indicate that the impact of TE_TA on bank efficiency is much stronger and more robust (see Tables 3 and 4).

The variables to capture the bank liquidity effects are not statistically significant in FE and RE estimations as given in Table 1 using constant returns to scale measure. However, the non-earning assets to total assets ratio (NEA_A) is statistically significant in Table 2 using variable returns to scale. We also notice that the loan loss reserve to gross loans ratio (LOANLR_GL) and non-earning assets to total assets ratio (NEA_A) variables are statistically significant in FE2SLS and RE2SIS estimations as indicated in Tables 3 and 4. The provisions for more reserves to protect loan losses and more liquid assets tend to improve the overall productive performance of banks.

The off-balance sheet effect of banks (OFFBAL_A) is negative and statistically significant at 1 percent level to both the FE and RE estimation specifications. It is also robust to the FE2SLS and RE2SLS estimations. The negative coefficient of off-balance sheet activities

indicates that constraining the non-traditional activities of banks will have a positive outcome on the efficiency of banks.

Foreign participation and ownership in the financial sector have positive effects on banking efficiency (see the positive and statistically significant coefficient for the FOREIGN variable). Again, the result is robust to both CRS and VRS estimations and also to the 2SLS estimations given in Table 3 and 4. We notice that the impact of foreign participation is stronger with variable returns to scale (VRS).

There is a negative coefficient on the SUBSIDIARY variable. This result is statistically significant at 1 percent level and robust to FE2SLS and RE2SLS estimations. This indicates that there are moral hazard issues if banks take ownership of companies and if banks are bought by corporations.

The results indicate that the types of banking activities have different impacts on the efficiency of banks in Southeast Asia and thus diversification of banking activities is important to maintain banking performance and efficiency. Commercial, savings banks, and holding finance companies tend to have a lower levels of banking efficiency. In contrast, investment banks and finance & security companies show higher efficiency and performance in our sample. It is also interesting to observe that more prudent types of banking such as the government savings banks and Islamic banking are associated with higher levels of efficiency. The effect of different types of banks on bank efficiency might also depend on development stage of growth of the economy. For example, the Government Savings Bank of Thailand was set up in 1913 to educate the people on banking services and promote savings among the general population. Thus, the traditional role of banks in the resource allocation by mobilization of savings through

deposits to productive investments tends to increase bank efficiency in developing countries. These results are also robust to the FE2SLS and RE2SIS estimations.

4.2. Bank Regulation and Supervision

The results for the banking regulation and supervision variables of RESTRICT (restrictions on activities that generate non-interest income), MONITOR (intensity of private monitoring) and OFFICIAL (index of official supervision) are statistically significant and robust to both the CRS and VRS measures and also to the FE2SLS and RE2SLS estimations.

The MONITOR variable in our study is negative and statistically significant at one percent level. This result is very robust in our FE2SLS and RE2SLS specifications. This result is also supported by the recent study by Gonzales (2009) that indicated a negative coefficient for intensity of private monitoring of financial markets. The negative coefficient in our study indicates that private monitoring does not yield positive outcome for the financial markets in Southeast Asia. It is likely that more developed and well diversified financial markets will rely heavily on the private sector to provide information on the activities of the banks for depositors and potential investors. But given the stage of growth of the financial markets in Southeast Asia and developing countries, private monitoring might not produce a positive impact in these countries as compared to those hosting well-developed financial markets. This result is also supports the views expressed during the recent Global Financial Crisis and during the Asian Crisis concerning the moral hazard issues related to weak private sector monitoring of the financial markets by rating agencies and private investors.

In contrast, the supervisory and regulatory role of the central bank seems to produce a positive outcome in terms of improvements in the bank efficiency of the financial institutions in

Southeast Asia. The RESTRICT variable that captures the restrictions on activities that generate non-interest income is positive and statistically significant. This suggest that regulatory role of central banks in the region is crucial to bank efficiency. Monitoring and regulating the balance sheet activities of banks tends to improve the productive performance of banks in our sample. The coefficient on the bank supervisory variable (OFFICIAL) is also positive and statistically significant in our estimations. The transparency of supervisory function and official authority of the supervisory activities of the central bank improve banking efficiency. In comparison, the variable on the restriction of activities of non-income (RESTRICT) tends to have a higher coefficient in our estimation indicating that restrictions on bank activities are associated with higher increments to bank efficiency compared to the OFFICIAL variable.

Conclusion

The paper studied the determinants of efficiency of banks in Southeast Asia using individual bank data from 1994 to 2008. The study controlled for bank heterogeneity and endogeneity issues by adopting the two-stage least square estimation of fixed- and random effects as provided by Baltagi (2001).

The results of the study indicate that higher capital requirements in terms of the total equity to total assets ratio seem to improve the bank efficiency. This result is in line with the recommendations by Basel II Accord (2006) that suggests that capital requirements could mitigate credit risk and operational risk of banks by shifting the risk taking activities more to the managers and owners of banks. Recently, the Council of Foreign Relations (2009) also suggests that capital requirements could be an effective tool to discipline the risk taking activities of large banks. For example, the failure of a large national banks is certain to have bigger impact on the banking system and on the overall economy, thus large banks should have higher capital requirements than smaller banks given other factors are the same. Furthermore, capital requirements linked to the risk sensitive assets and short-term debt could be an effective tool to discipline risk taking activities of the banks. During crisis, banks might not be able to obtain the short-term financing to cover their short-term loans and are forced to sell their assets at fire sale priced and reduce the number of loans. Thus capital requirements should be higher for banks that have risk-sensitive assets and finance their operations with short-term debts.

The results of the paper also highlight certain key activities that could be valuable to policy makers to improve the banking efficiency and stability in the financial markets. More extensive non-traditional banking activities, in terms of off-balance sheet activities, is associated

with lower levels of efficiency. This is an important result in relation to the current Global Financial Crisis and financial innovation activities of banks.

More extensive corporate linkages to a bank tend to reduce its efficiency. Based on the experience from the Asian Crisis, linkages with corporations which may induce moral hazard have to be monitored and the transparency of such relationships will be very important for the stability of the financial system. Although there is greater monitoring of such linkages since the Asian Crisis, they still exist in the Southeast region.

Given the different stages of financial and economic development, a greater concentration on traditional banking activities such as government savings banks and Islamic banking has a positive impact on efficiency. Although the traditional banking activities yield productive outcomes for the banks, the results also highlight that a well diversified banking sector has greater impact on the productivity of the financial sector.

As compared to private sector monitoring of the financial activities, it seems the role of banking regulation and supervision is of paramount importance to the efficiency of the banks in the Southeast Asia. Given the diverse stages of growth and development in the region, the role of central banks is very crucial to monitor the activities of the banks. The results of the paper highlight the importance of bank regulation and supervision for improving the bank efficiency in the region as compared to the private sector monitoring the banking activities. In particular, restrictions on risky activities of banks tend to produce more efficient banks. Thus central banks in the region should develop better system of monitoring and supervising the risk sensitive activities of the banks.

The results of the paper also have important implications for liberalizing the financial sector in terms of increasing the foreign ownership and participation. The results indicate that

there are positive impacts on bank efficiency from foreign ownership and participation. The financial openness of the financial markets will be important for the development and regional integration of the financial market.

The results of the paper clearly indicate that bank regulation and supervision will be crucial to improve the efficiency of the banks and maintain stability in the financial markets in the Southeast Asia. However, the types of bank regulation and supervision produce different results and recognition of impact of different policies will be important to achieve the desired outcomes. The right balance between creating a competitive market including foreign participation alongside prudent banking regulation and supervision will be important for banking efficiency and stability in financial markets.

References

Baltagi, Badi H. 2001. *Econometric Analysis of Panel Data*, New York: John Wiley and Sons.

Barth, James R., Gerald Caprio Jr., and Ross Levine, 2004. "The Regulation and Supervision: What Works Best?" *Journal of Financial Intermediation*, 13, 205-48.

Barth, James R., Gerald Caprio Jr., and Ross Levine, 2006. *Rethinking Bank Supervision and Regulation: Until Angels Govern*, Cambridge, UK: Cambridge University Press.

Berger, A.N., Hancock, D., & Humphrey, D.B. (1993). "Bank efficiency derived from the profit Function", *Journal of Banking and Finance*, 17, 317-347.

Berger, Allen and David B. Humphrey, 1997. "Efficiency of Financial Institutions: International Survey and Directions for Future Research", *European Journal of Operational Research*, 98, pp. 175-212.

Berger, Allen N. and Loretta J. Mester, 1997. "Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions," *Journal of Banking and Finance*, 21, pp. 895-947.

BIS, 2006. "International Convergence of Capital Measurement and Capital Standards", Basel Committee on Banking Supervision, CH-4200 Basel, Switzerland.

Brunnermeier, Mark, 2009. "Deciphering the Liquidity and Credit Crunch 2007-2008", *Journal of Economic Perspective*, Vol. 23, No. 1, pp. 77-100.

Casu, B., Girardone, C., and Molyneux, P., "Productivity Change in European Banking: a Comparison of Parametric and Non-Parametric Approaches", *Journal of Banking and Finance* 28, No. 10, pp. 2521-2540, 2004.

Council of International Relations, 2009. "Reforming Capital Requirements for Financial Institutions", Centre for Geoeconomic Studies, Squam Lake Working Group on Financial Regulation, April 2009.

DeYoung, Robert and Daniel E. Nolle, 1998. "Foreign-Owned Banks in the US: Earning Market Share or Buying It?" *Journal of Money, Credit and Banking*, 28, pp. 622-36.

Edwards, Franklin and Frederic S. Mishkin, 4993. "The Decline in the Traditional Role of Banks: Implications for Financial Stability and Regulatory Policy," NBER Working paper 4993, NBER, Cambridge, MA 02138.

Gonzalez, Francisco, 2009. "Determinants of Bank-Market Structure: Efficiency and Political Economy Variables", *Journal of Money, Credit and Banking*, Vol. 41, No.4, pp.736-754.

Isik, Ihsan and Kabir Hassan, M, "Financial Deregulation and Total Factor Productivity Change: An Empirical Study of Turkish Commercial Banks", *Journal of Banking and Finance* 27, No. 8, pp. 1455-1485, 2003.

Kaplan, Ethan and Dani Rodrik, 2001. "Did the Malaysian Capital Controls Work?" NBER Working paper 8142, NBER, Cambridge, MA 02138.

Kose, Ayhan, Prasad, Eswar S. and Terrones, Marco E., 2009. "Does openness to international financial flows raise productivity growth?," *Journal of International Money and Finance*, Elsevier, vol. 28(4), pages 554-580, June.

Leightner, Jonathan E. and Knox Lovell, 1998. "The Impact of Financial Liberalization on the Performance of Thai Banks," *Journal of Economics and Business*, 50, pp. 115-31.

Montgomery, Heather, 2003. "The Role of Foreign Banks in Post-Crisis Asia: The Importance of Method of Entry", ADB Institute Research Paper No. 51, ADB Institute, Tokyo.

Obstfeld, Maurice, 2009. "International Finance and Growth in Developing Countries: What have we learned?" NBER Working paper 14691, NBER, Cambridge, MA 02138.

Radelet, Steven and Jeffrey Sachs, 1998. "The Onset of the East Asian Financial Crisis", NBER Working paper 6680, NBER, Cambridge, MA 02138.

Schaeck, Klaus, Martin Cihak, and Simon Wolfe, 2009. "Are Competitive Banking Systems More Stable," *Journal of Money, Credit and Banking*, Vol. 41, No.4, pp. 711-734.

Strum, Jan-Egbert and Berry William, 2004. "Foreign Banks Entry, Deregulation and Bank Efficiency: Lessons from Australian Experience", *Journal of Banking and Finance*, Vol. 28 (7), pp. 1775-1797.

Wheelock, David C. and Paul W. Wilson, 1999. "Technical Progress, Inefficiency, and Productivity Change in US Banking, 1984-1993," *Journal of Money, Credit and Banking*, 31, pp, 212-34.

Xu, Ying, 2010. "Towards a more accurate measure of foreign bank entry and its impact on domestic banking performance: A case of China", Crawford School of Economics and Government, Australian National University.

Appendix

Table A2: Description of Variables

Period	1994-2008
Country	Coverage of Number of banks
Indonesia	129
Malaysia	131
Singapore	110
Thailand	73
The Philippines	83
Vietnam	43
Description	Variables
Total Equity/Total Assets	TE_TA
Loan Loss Reserve / Gross Loans	LOANLR_GL
Liquid Assets / Total Assets	LA_TA
Non Earning Assets / Assets	NEA_A
Off Balance Sheets / Assets	OFFBAL_A
Majority foreign owned	FOREIGN
Public bank (>25% Govt ownership)	PUBLIC
Subsidiary or has Subsidiary	SUBSIDARY
Bank Regulation & Supervision	
Bank Regulation: Restrictions on activities that generate non-interest income	RESTRICT
Bank Supervision: Intensity of private monitoring	MONITOR
Bank Supervision: Official Supervision	OFFICIAL
Bank Efficiency	
DEA efficiency, input CRS method	Input CRS
DEA efficiency, input VRS method	Input VRS
Sample size for DEA estimation for country-year	DEAsize

Table A2: Average Bank Efficiency for the years 1994-2008

	Input CRS	Input VRS
Indonesia		
1994 - 2008	0.269	0.484
1994 - 1998	0.210	0.431
1999 - 2003	0.430	0.662
2004 - 2008	0.170	0.359
2007 - 2008	0.184	0.329
Malaysia		
1994 - 2008	0.185	0.327
1994 - 1998	0.150	0.333
1999 - 2003	0.231	0.352
2004 - 2008	0.175	0.295
2007 - 2008	0.187	0.332
Singapore		
1994 - 2008	0.761	0.919
1994 - 1998	0.908	0.966
1999 - 2003	0.778	0.922
2004 - 2008	0.616	0.877
2007 - 2008	0.650	0.882
Thailand		
1994 - 2008	0.698	0.817
1994 - 1998	0.752	0.825
1999 - 2003	0.621	0.783
2004 - 2008	0.721	0.843
2007 - 2008	0.714	0.843
Philippines		
1994 - 2008	0.860	0.937
1994 - 1998	0.920	0.966
1999 - 2003	0.921	0.966
2004 - 2008	0.740	0.881
2007 - 2008	0.830	0.916
Vietnam		
1994 - 2008	0.060	0.113
1994 - 1998	0.025	0.025
1999 - 2003	0.048	0.050
2004 - 2008	0.105	0.114
2007 - 2008	0.120	0.131

Table A3: The Trends of Key Bank Variables from 1994-2008 (%)

	Year	TE_TA	LOANLR_GL	LA_TA	NEA_A	OFFBAL_A
Indonesia	1994-1996	10.4	1.8	23.1	5.3	11.8
	1997-1999	2.9	17.0	32.2	11.3	8.1
	2000-2008	14.5	7.1	32.6	9.9	15.0
Malaysia	1994-1996	8.8	3.2	23.9	18.5	38.1
	1997-1999	9.8	6.5	19.9	17.9	36.5
	2000-2008	16.0	8.3	29.2	20.4	24.7
The Philippines	1994-1996	17.2	2.0	25.2	8.4	29.0
	1997-1999	20.6	5.0	23.0	10.9	11.5
	2000-2008	15.4	9.6	22.5	13.5	10.0
Singapore	1994-1996	27.3	3.7	19.7	8.5	11.7
	1997-1999	14.9	10.9	19.5	7.8	15.1
	2000-2008	23.1	9.4	27.1	13.7	15.3
Thailand	1994-1996	9.3	1.5	9.5	3.7	14.3
	1997-1999	8.6	11.7	11.8	4.9	16.1
	2000-2008	19.0	8.4	15.4	10.4	19.2
Vietnam	1994-1996	18.0	6.5	25.7	8.9	16.3
	1997-1999	14.9	1.3	40.0	7.7	12.8
	2000-2008	13.0	1.2	37.5	9.3	10.0

Figure A1: Total Equity to Total Assets (TE_TA) for Selected Asian Countries

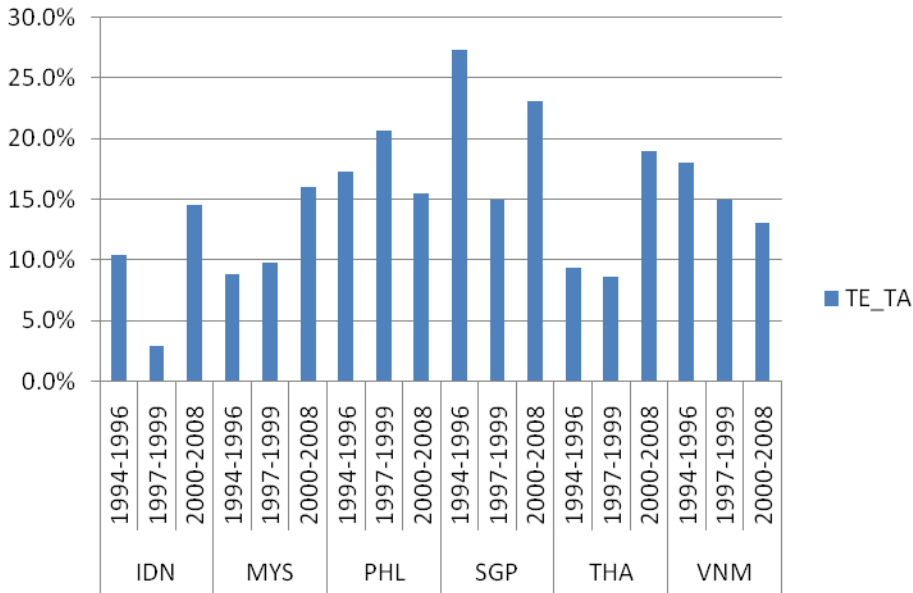


Figure A2: Loan Loss Reserve to Total Assets (LOANLR_GL)

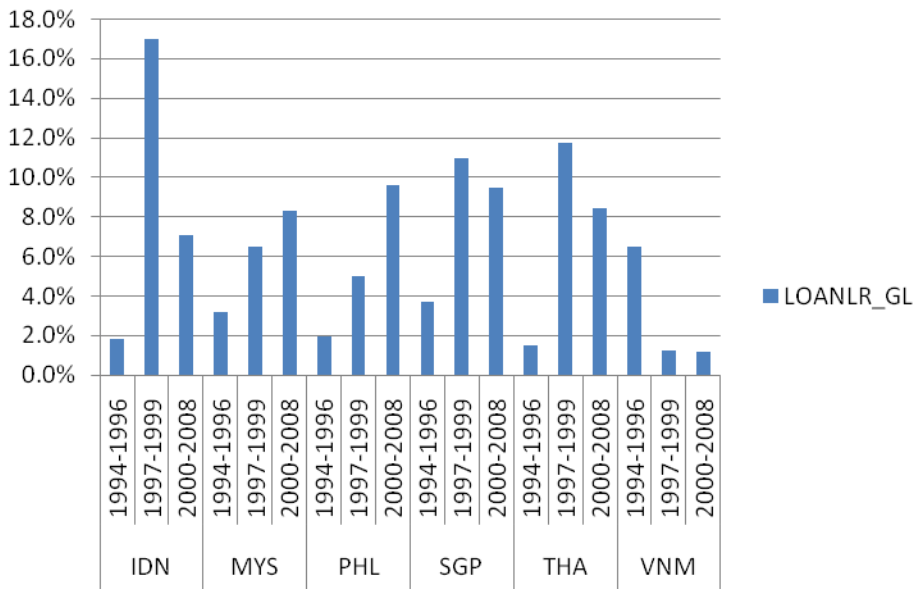


Figure A3: Liquid Assets to Total Assets (LA_TA)

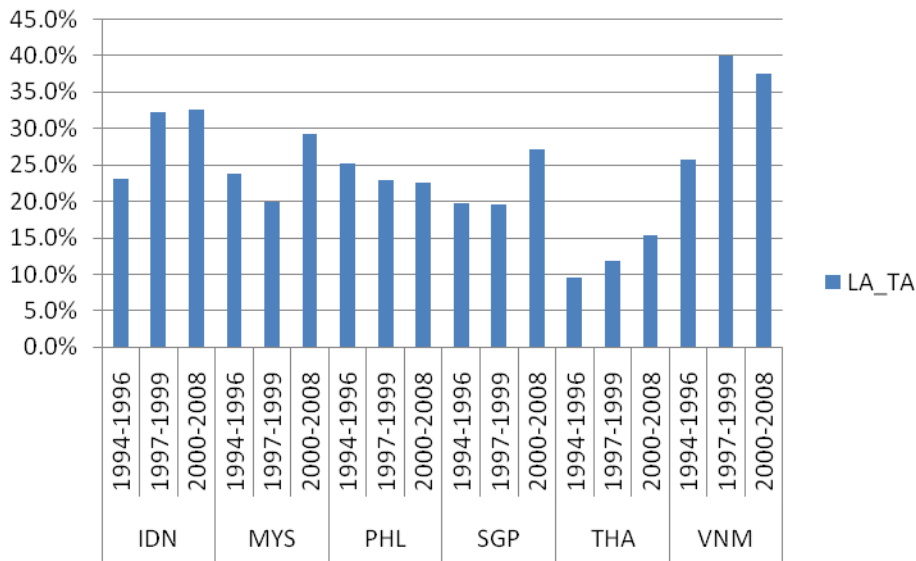


Figure A4: Total Non-Earning Assets to Total Assets (NEA_A) for Selected Asian Countries

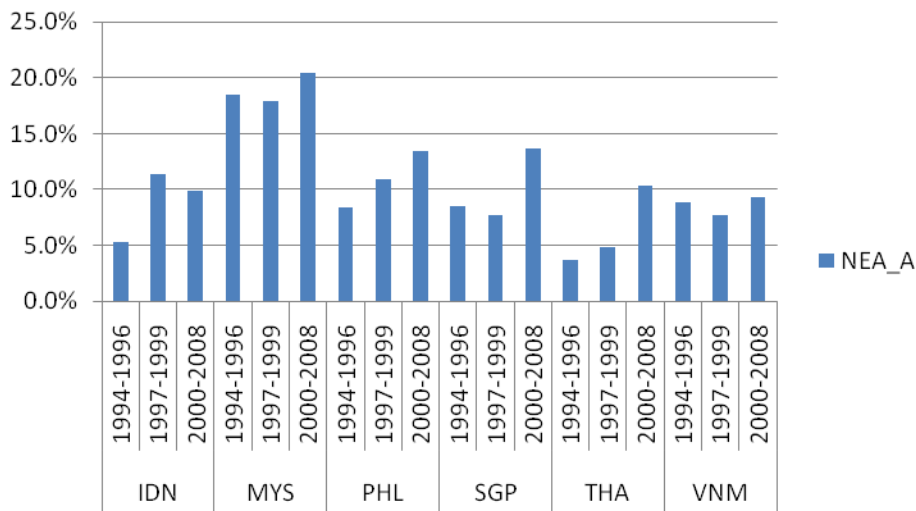


Figure A5: Off-Balance Sheet Activities to Total Assets (OFFBAL_A) of Selected Asian countries

